derive nitrogen from the air," but, on the contrary, has pointed out that all the nitrogen assimilated by them may be accounted for in the different compounds of that body which are supplied to the plant in other ways. Boussingault's experiments also on the nutritive properties of the nourishment supplied to herbivorous animals are of great interest. In these he has traced the distribution of the various constituents of the food by the vital process, and has determined the different quantities of the various constituents which undergo assimilation. Besides investigations in the directions just indicated, he has introduced various improvements in methods of analysis, and has published many valuable articles, most of which are collected in his "Mémoires de Chimie Agricole et de Physiologie;" he has also written a work entitled "Traité d'Economie Rural."

With the work of Mr. J. Allan Broun most of our readers must be familiar. On the commencement of magnetic observations he indicated the errors or insufficiencies of the methods for determining coefficients and correcting the observations issued by the committee of the Royal Society for the instruction and direction of superintendents of observatories; he devised new methods for these ends which have made the observations in all the magnetic observatories available for strict scientific conclusions. He has made investigations in magnetism and meteorology during thirty-five years; among the new results obtained many of them are of the highest value, and have taken their place as standard scientific data. He established an observatory twice on a mountain-peak 6,000 feet above the sea, with the complement of instruments employed in first-class observatories (on the second occasion with a double series of magnetical instruments)—this, in a wild country, done amidst great difficulties in erecting instruments and obtaining trained observers, requiring continued and persevering action. This and many other duties were done at his own expense, and though, in general, ultimately repaid, they yet included considerable pecuniary loss. He also spent his own means in obtaining new instruments, and in every matter likely to forward science. He has laboured for years without remuneration in scientific work of a peculiarly tedious kind.

Albert C. L. G. Günther is the Keeper of the Zoological Department of the British Museum, a position to which he succeeded on the death of Dr. J. E. Gray. Very early in his life he devoted himself to the study of the natural sciences, and, if we are not mistaken, his earliest essay as an author was a very complete memoir of the fishes of the Neckar. About 1854 he accepted an appointment in the British Museum under Dr. J. E. Gray, who soon learned to value and appreciate the services of his assistant. Dr. Günther commenced the investigation and arrangement of the batrachian reptiles in the National Collection, with a zeal and energy that knew no limits, and which soon rendered this portion of the Zoological Department without a rival among the Museums of Europe. Not wearied by such a task he set about a far greater one, the arrangement and description of the immense class of the fishes, and no zoologist has ever raised a greater or more enduring monument to his memory than Dr. Günther has done in his great and truly scientific catalogue of all the known fish. The care of a large and daily-increasing collection, with all the worry incident on the want of room to properly store it—the toil and labour involved in the publication of the extensive work just alluded to, might well have excused Dr. Günther from attempting other work, but still we find him apparently never weary, and memoirs of a value like those on Hatteria, on Ceratodus, and on the Giant Tortoises, not to mention a long list of others, were being constantly published by him. He is also the author of an important work published at the expense of the Ray Society, "On the Reptiles of British India," and joint author with Col. Playfair of a work on the "Fishes of Zanzibar." All will agree that his name is a very worthy one to be added to the grand roll call of the Royal Society's medallists.

The name of M. Alfred Cornu must be familiar to the readers of NATURE in connection with his remarkably ingenious and successful method of determining the velocity of light. A detailed account of M. Cornu's method will be found in vol. xi. p. 274, and succeeding volumes of NATURE. It was also expounded by him, it may be remembered, at the Royal Institution, on May 7, 1875. The important bearings of M. Cornu's experiments in various directions, we need not point out; its value in attaining an accurate estimate of the sun's parallax is evident. As is evidenced by the *Comptes Rendus*, M. Cornu's work in his own department is constant and varied; his research into the spectrum of the star that appeared in Cygnus two years ago was a fine example of the result of spectroscopic research; an account of it will be found in NATURE, vol. xv. Although probably the youngest of the new medallists, M. Cornu's long and incessant work makes him almost a veteran in scientific research.

MM. L. Cailletet and Raoul Pictet have lately been so closely engaged in the same kind of experimental work, namely, the liquefaction of gaseous bodies, that their names have naturally become associated in connection with the important results which have followed their independent researches. The methods, however, employed by the two chemists in obtaining those results which have lately added so much to their reputation are to a certain extent different. Cailletet's experiments, which were conducted on the gases air, hydrogen, marsh gas, nitric oxide, and carbonic oxide, depend for the cold necessary to produce the liquefaction of the gas, on the expansion of the gas when suddenly compressed only at moderate degrees of cold.

Pictet's experiments, on the other hand, are the result of his endeavours to discover improved methods for producing and maintaining for a considerable time very low degrees of temperature. Combining these improvements with the production of the bodies to be liquefied under great pressure, he has succeeded in liquefying oxygen and hydrogen and in solidifying the latter. He has also determined the specific gravities of the gases when in that condition, assigning to them the weights ·9883 and ·9787. Besides his most recent researches on the condensation of gases, M. Pictet has carried out other investigations on those phenomena, the consideration of which lies between the provinces of physics and chemistry. Among such investigations may be mentioned his observations on the application of the mechanical theory of heat to the study of volatile liquids and to some simple relations between the latent heats, atomic weights, and tensions of vapours. M. Pictet has also been successful in applying his scientific investigations to practical use, in the perfecting of apparatus for the rapid production of large quantities of ice.

We are glad to know that the health of M. Pictet is not so seriously impaired by overwork as was rumoured a few days ago. On the best authority it is stated that his recovery is by no means beyond hope, and that he is not suffering from incipient softening of the brain. There is no contradiction, however, to the sad statement that the sight of one of M. Pictet's eyes is gone, and that he will probably lose the power of the other.

AFGHANISTAN

WHATEVER opinions our readers may hold as to the present action of the Government with respect to Afghanistan, it may not be considered inappropriate to summarise briefly what we know about a country, which at no remote date may become a part of the British

Empire. A good deal has been written on the country, and some valuable records of the observations of travellers who have been permitted to penetrate it have been published. One of the best sketches of Afghanistan in its various aspects will be found in the magnificent "Noveau Dict. de Géog. Universelle," by Vivien de St. Martin, now being issued by Hachette and Co. On this the present article is mainly based. For further details we would refer our readers to this work, and the long bibliography appended to the article, as well as to a paper in the *Geographical Magazine* for October, and a pretty exhaustive account of the botany of the country in the *Gardener's Chronicle* of November 2, and the works referred to in these two journals.

As a whole, Afghanistan may be regarded as a mountainous table-land. It is the eastern half of the table-land of Iran, of which Persia occupies the western half. On the eastern side, towards Sind, the table-land sinks into what may be considered as parallel chains, forming so many staged terraces; one of these chains, more elevated than the others, and from which shoot several remarkable peaks, is known by the name of the Sulieman Mountains—*Soleimân-Kôh*. The mean height of this transverse chain is about 9,000 or 10,000 feet. The Sulieman Mountains are about sixty miles distant from the Sind border, though the crest of the plateau is not reached for about another 150 miles. On the south side the plateau descends by similar, but perhaps less pronounced gradations, towards the sea; up to the present time the southern slope has been but incompletely explored. To the west the Afghan plateau undergoes a very considerable depression, at the bottom of which lies the marshy lake, Hamoun, into which the Helmand river finds its way; but it again rises in the vast plains which lead towards Farsistan. On the north the plateau falls rapidly towards the plains through which flows the Oxus, and in the north-east it is connected with the highlands of Central Asia and the Himalayas by the enormous mass of the Hindu-Koosh. The highest summits of the latter chain, which conceals the deep basin of the Cabul river, are lost in the regions of eternal snow; many of its peaks exceed 20,000 feet in height. The Khavak Pass, one of the principal passes of the Hindu-Koosh, is at a height of more than 12,000 feet. On the south the basin of the Cabul river is shut in by the Sefid-Kôh chain, which runs, like the Hindu-Koosh, from west to east, and the highest summits of which, to the south-south-east of Jellalabad, reach a height of more than 13,000 feet. The source of the Cabul river is about 8,000 feet above the sea, and of the Helmand, more than 9,000 feet. All this extreme zone of Afghanistan is only a mass of mountains cut by a multitude of rugged valleys; this is the coldest part of the country. A mass which dominates it, above the sources of the Cabul and the Helmand, the Kôh-i-Baba or "Father of Mountains," rising to a height of 15,000 feet, may be regarded as the knot which connects the Hindu-Koosh with the Mountains of Ghour. It is in this cold region, which commences at the Mountains of Ghour and is continued eastward by the long valley of the Cabul river, that the primitive race of the Afghan people have been formed, a race uncultured, rude, and vigorous like their native valleys.

With the exception of the two basins of the Cabul and the Helmand, Afghanistan is characterised by a scarcity of running water. Elphinstone had noticed this prevailing feature, and all subsequent observations have confirmed it. Only four or five rivers of any consequence flow down the long eastern slope of the plateau, and some of these are lost in the sands. The Helmand, fed by many affluents, after a course of about 600 miles, discharges into a large shallow lake, nearly all covered with reeds. This lake, known variously as Hamoun, Meshileh-Seistan, or Meshileh-Rustem, is black and nauseous, changes greatly in its configuration, sometimes even dividing up into two distinct basins.

Four-fifths of the surface of Afghanistan is, on the whole, a country of rocks and mountains, interspersed here and there with picturesque valleys, fertile and well watered, but presenting in several directions only elevated plains, cold, arid, and covered with meagre pasturage, which, however, supports numerous flocks. Situated under the parallels of Egypt and Syria, but with a surface not less varied than that of Switzerland, and mountains much more elevated than the Alps, Afghanistan combines in its climate and its products the extremes of the torrid and temperate zones. As the meagreness of its water-supply is characteristic of many parts of the country, dryness is the dominant feature of its climate, as also extremes of temperature, according to the season.

Of the geology of Afghanistan scarcely anything is known by direct observation. Its mineral products, however, appear to be abundant enough. The sands of the Cabul river are known to furnish gold. The Hindu-Koosh mountains contain silver, copper, cinnabar, lead, antimony, zinc, sulphur, &c. Iron especially abounds there, and copper is found in many other parts of the country; coal also has been proved to exist in several localities. Rock salt has given its name to an entire chain of mountains which stretch into the north of the Punjâb. In the north of Damân, in the neighbourhood of Kohat, are mines of sulphur and wells of naphtha.

The character of the vegetation in all the higher parts of Afghanistan is essentially European; all kinds of fruits abound, and many of them are found in a wild state. From the article on the botany of Afghanistan in the *Gardeners' Chronicle* of November 2, we find the following statement as to the general characteristics of the vegetation of the country:—

"Afghanistan abounds in spiny plants; herbs are to a great extent replaced by dwarf prickly shrubs having a relatively small amount of leaf-surface; and bulbous plants are also numerous. Fragrant flowers prevail, and resiniferous and oleiferous plants are numerous. Stocks, who travelled in Beloochistan and the southern borders of Afghanistan, says the upper region especially is remarkable for the fragrance of its plants, as Artemisia, Perowskia, Salvia, Teucrium, and other Labiatæ, from which cause the flesh of the sheep and goats acquires a fine and almost aromatic flavour. There is no nakedness of the soil, for hill and plain are alike covered with depressed shrubs, although their scorched aspect, after the sun acquires power in June, is anything but agreeable to the eye. The prevailing tint of the indigenous vegetation and of the landscape of the uncultivated plains is olive-green, though the well-cultivated valleys, as Quettah, are charmingly green in the spring time. The aspect of the vegetation of the lower region is far different, the plants being few and scattered over the bare brown and stony soil. Even in spring no annuals appear to diversify the scenery, and the under-shrubs are remarkably similar in external appearance. Woody, stunted, thorny, not above 1 foot high, with round cushion-like outlines, bleached stems, and a few leaves—they look like skeletons of plants, the grey ghosts of a vegetation which has perished of thirst. The glaucous aspect of all, and the universality of spines, are noteworthy features."

Wild animals are not over-abundant. The high valleys of the Hindu-Koosh shelter lions and leopards, which have neither the size nor ferocity of those of India. Wolves are met with, and in the eastern jungles tigers and hyænas. There are two species of bear, a black and a brown, but elephants are not found in the wild state. Jackals and foxes are numerous, monkeys in the north-east, and wild sheep and goats in the mountains of the north. The Angora cat is said to have originally come from Cabul.

There is probably no country of equal extent which presents so great a mixture of races, though the two main divisions are Afghans proper, and Tajiks. The former name is applied to all those tribes that speak Pushtu or Pukhtu, the other to those of the people whose native language is Persian. To the latter are also given the names Parsivân and Deggän or Dekkân. The Afghans are mostly pastoral, while the Tajiks are sedentary and cultivate the soil. To these two great classes must be added the Hindkis, of Hindu origin, and speaking Hindustani, very numerous in the eastern districts; also the Hezareh, a people with Mongol features but speaking Persian, found mainly between Ghazna and Herat. The Kisil-bash or "Red Heads," although not very numerous, are an important factor in the population. They are not Persian by origin, as is commonly stated, but belong to one of the Turcoman tribes of Persia. There has been much discussion as to the origin of the Afghans, no doubt the true aborigines of the country. Some have sought to find in them the descendants of the captive ten tribes of Israel; but this is a mere fanciful Mussulman tradition. Their language, at least, proves that they belong to the great Indo-European family, and that in this family they are specially allied to the Iranian group, but with a linguistic development peculiar to themselves, showing also the influence of Sanscrit. Moreover, it can be conclusively established, both by historical and ethnological evidence, that from the most ancient times the Afghans have inhabited the basin of the Cabul river, which is still the principal seat of the race. The true national name of the Afghan people, the name recognised by themselves, is that of Pashtoûn, Pakhtoûn, or Poukhtanêh. In physical type the Afghans, like all the other peoples of Western Asia, approach the European conformation; the difference being in physiognomy, not in type. Like most other primitive peoples, the social organisation of the Afghans is based on the tribe or clan, and in many respects, it has been said, resembles the old clan system of the Scottish Highlands.

OUR ASTRONOMICAL COLUMN

THE SOLAR ECLIPSE OF 1879, JULY 19.—Though the second of the solar eclipses of next year will not be actually total at any point upon the earth's surface, the difference between the geocentric diameters of sun and moon is sufficiently small to allow of the effect of the augmentation upon the latter, bringing up the phase to one nearly approaching totality in those parts which have the sun close upon the meridian. In the longitude of Aden, or rather, upon the opposite coast of Africa, about Zeyla, the moon's augmented semi-diameter will be only four seconds less than that of the sun, and though the eclipse thus remains annular, it will be seen that the annulus is very narrow in this part of its path—including its passage across Abyssinia. At Aden, there will be a very large eclipse, beginning at 10h. 23m. A.M., local mean time, and ending at 2h. 1m. P.M.; at greatest phase about 0h. 12m., the magnitude will be 0·97 of the sun's diameter. The difference between the illumination of the sky while any portion, no matter how small, of the direct light of the sun remains, and the instant it is entirely extinguished in a total eclipse, is so great as we know from our experience of total eclipses, that there may probably be a doubt as to the possibility of utilising the eclipse in question, in a further endeavour to observe the intra-mercurial planet or planets discovered by Prof. Watson. The next total eclipse of the sun will take place on January 11, 1880, and although, notwithstanding the long track of the shadow across the Pacific Ocean, it may be possible to secure observations, the interval available for so doing cannot be more than half that at the command of observers during the eclipse which traversed the United States last July.

COMETS OF SHORT PERIOD.—An ephemeris of Brorsen's comet, which, according to the calculations of Prof. Schulze, will arrive at perihelion on March 30, 1879, will be found in *Astron. Nach.*, No. 2,220; as already stated in this column, it is likely that the comet will be first observed at the southern observatories. About six weeks later Tempel's comet, 1867 II, which was re-observed in 1873, after undergoing great perturbation from the planet Jupiter, will be due at perihelion; the elements deduced from the observations of 1873 alone, by Dr. Sandberg, would assign, without taking account of perturbation, April 26 for the perihelion passage, but according to an orbit just published by M. Raoul Gautier, of Geneva which he says may be considered the most probable one till the observations to be expected next year, afford additional means of determining the mean motion, the comet would not be in perihelion till May 8, in which case its apparent track in the heavens will differ little from that which it pursued in 1873, when it arrived at its least distance from the sun on May 9. It is pretty sure to be always a faint object except for the larger telescopes, and considering the uncertainty which still appears to exist regarding the mean motion at its last appearance, a close search may be necessary for its rediscovery. M. Gautier is calculating the effect of Jupiter's attraction during the actual revolution, with the intention of publishing an ephemeris in due time; this effect, however, must be small, as the comet has not been nearer to the planet than about 1·5 during the interval. The ensuing return of Faye's comet in the latter part of the year 1880 will take place under much more favourable circumstances for observation than has been the case at any of its appearances since 1843, when it was first detected by the French astronomer; indeed, in 1851, 1858, 1865-66, and 1873 it was always a faint object, but the admirable calculations of Dr. Axel Möller have enabled us to follow its course with extreme precision, with a precision perhaps greater than has yet attended similar investigation in the case of any other comet during so long a period. Though the date of perihelion passage is not yet exactly ascertained, the comet will probably approach almost as near to the earth as in the autumn of 1843, and will be observable for many months.

THE SATURNIAN SATELLITE MIMAS.—According to elements which represent approximately the Washington observations, 1874-77, the following will be times of greatest eastern elongation of Mimas:—

	h.		h.
November 15 at	12·3	November 18 at	8·1
,, 16 ,,	10·9	,, 19 ,,	6·7
,, 17 ,,	9·5		

At these times, on the assumption of circular motion, the distance of the satellite from the end of the ring would be about 8′.

THE MINOR PLANET ISMENE.—According to a calculation of the elements of the small planet *Ismene*, No. 190, by Herr Leman, from observations between September 30 and October 31, it very closely approaches *Hilda*, in its exceptionally great distance from the sun, and consequent length of the period of revolution. We have for comparison:—

	Ismene.		*Hilda.*
Mean distance	3·893	...	3·950
Aphelion distance	4·466	...	4·595
Sidereal period in days ...	2·805	...	2·855
,, ,, years ...	7·68	...	7·85

Another group is formed by *Cybele*, *Freia*, *Sylvia*, *Camilla*, and *Hermione*, wherein the periods vary from 2297 days to 2377, the mean distance for the group, 3·451. Eventually the planets which approach so near to the orbit of Jupiter, as *Ismene* and *Hilda*, will furnish independent determinations of his mass, though the narrow limits of probable error, within which its value